
INDOT 2030 Long Range Plan

Highway Needs Analysis

Overview

The statewide transportation planning process provides for the identification of highway needs through a comprehensive process of the review of past planning studies, current planning programs, and the quantitative analysis provided by the application of the statewide system planning tools.

Previously Identified Projects

The first step in the statewide expansion needs analysis process was to identify projects which have already been documented as a need in some form of previously conducted transportation planning and/or programming study. The primary sources for this identification process were the INDOT Production Schedule and the MPO Long Range Plans.

INDOT Production Schedule

The INDOT Production Schedule, the State Project Management System (SPMS) is a six to ten year program of projects under development (past planning level analysis) by INDOT. The production schedule provides a template of development activities and associated time requirements for tasks within each project. These required development activities outline a process which includes: (1) Engineering Assessment, (2) Environmental Assessment, (3) Design Plan Development, (4) Land Acquisition and (5) Construction. Development time for capacity expansion projects (interchange modifications, new interchanges, added travel lanes and new road construction) requires a minimum of seven to eight years, assuming no delays and existing funding.

Projects which have been programmed into the production schedule have generally originated through the INDOT District development process and the Central Office planning and programming project identification activities. Potential projects are identified through the Program Development Process (PDP) which includes annual meetings with the Districts and MPOs. The Federal-Aid projects programmed for the first three years of the production schedule provide the basis for the Indiana Statewide Transportation Improvement Program (INSTIP). The INSTIP is presented for transportation stakeholder and public review and comment in a series of INDOT District Meetings held in late summer (as well as distribution to the MPOs for their public involvement process). At these meetings, information is also provided on projects in the production schedule which are beyond the three-year program of the INSTIP. In the initial development of the plan, approximately 300 capacity expansion projects were identified from the INDOT production schedule with an associated funding requirement of \$ 5.8 billion.

The fourteen Indiana Metropolitan Planning Organizations (MPOs) provide comprehensive transportation planning analysis for project identification in the state's major urban centers of over 50,000 in population. Each MPO is required by federal regulations to develop a twenty year transportation plan identifying transportation needs on the state and local jurisdictional roadway systems. The MPOs also carry out a multimodal planning process identifying potential public transportation, high occupancy modes, and bicycle / pedestrian transportation improvements where warranted.

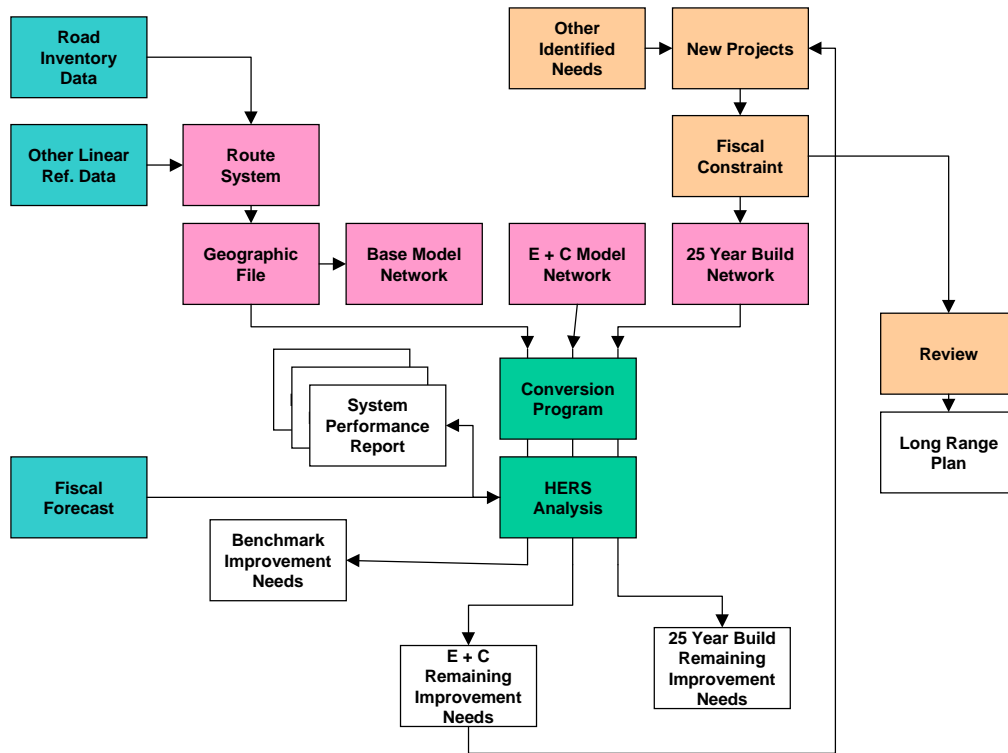
Statewide Technical Needs Analysis

An effective statewide transportation planning process depends upon the ability to conduct a quantitative analysis measure of transportation system performance and the impact of transportation improvements. The 1995 Statewide Long-Range Multimodal Transportation Plan identified this planning objective: "INDOT will develop a comprehensive set of planning tools that will allow for system-level analysis of the state transportation system. These tools will include a geographic transportation information system, multimodal travel demand forecasting capabilities, and methodologies to identify the economic impact of transportation investments." Technical planning tools developed to address this objective include:

- TransCAD based Statewide Travel Demand Model and Geographic Information System
- Major Corridor Investment Benefit Analysis System (MCIBAS)
 - Corridor Travel Demand Analysis
 - Benefit/Cost Analysis Framework
 - User Benefit Analysis---(NET_BC)
 - Economic Impact Modules (Business Attraction, Business Expansion, Tourism)
 - REMI Economic Simulation Model
- Indiana State Highway Economic Requirements System (HERS_ST_IN)
- INDOT Management Systems (Coordination with pavement, bridge, public transportation, intermodal, congestion and safety management systems).

These system planning tools provided the basis for the INDOT needs analysis. The results of the travel demand model provided the foundation for the needs analysis. The key elements of the system planning tools and their relationship to the travel demand model are shown in the graphic below. Future traffic forecasts were used to identify future capacity deficiencies. In addition, future travel demand growth rates provided the primary input into the HERS_ST_IN needs analysis model to identify added travel lanes improvements. At each decision point in the identification of deficiencies and potential improvement selection process, the output of the transportation system planning tools were reviewed by experienced transportation planners and project development engineers from each of INDOT's six (non-toll road) districts and thirteen MPOs. This continuing review by local experts rationalized the output of the quantitative analysis with engineering and planning judgement.

Figure 9-1 Statewide Technical Needs Analysis Process



Roadway

The roadway data used in the statewide transportation planning process is obtained from the INDOT Road Inventory File maintained by the Program Development Division. This computer data base provides a comprehensive inventory of roadway physical features and traffic count information necessary for the development of the system planning tools. The development of the TransCAD based routing system and GIS allowed the creation of electronic databases through the process of dynamic segmentation. This database provides the foundation for the statewide planning tools and the ISTE management systems.

Highway Capacity

The ability of a roadway to carry traffic provides the basic input for the identification of needed highway improvements for added travel lanes and new roadway construction. The highway capacities used for the establishment of system needs were developed through coordination with the Division of Program Development's Congestion Management System. The highway carrying capacities were developed using the procedures of the Highway Capacity Manual.

Indiana Statewide Travel Demand Model (ISTDM)

Model Overview

Statewide models are designed to provide the analytical framework for assessing transportation system performance and deficiency analysis, long range plan development, systems level project analysis, as well as to provide the spatial analytical framework for many of the management systems. Indiana's Statewide Travel Demand Model (ISTDM) provides the cornerstone for system planning tools and coordination with the INDOT Congestion Management System and Safety Management System. The Statewide Travel Demand Model was developed using a TransCAD application, which integrates Geographic Information System (GIS) and planning modeling functionality.

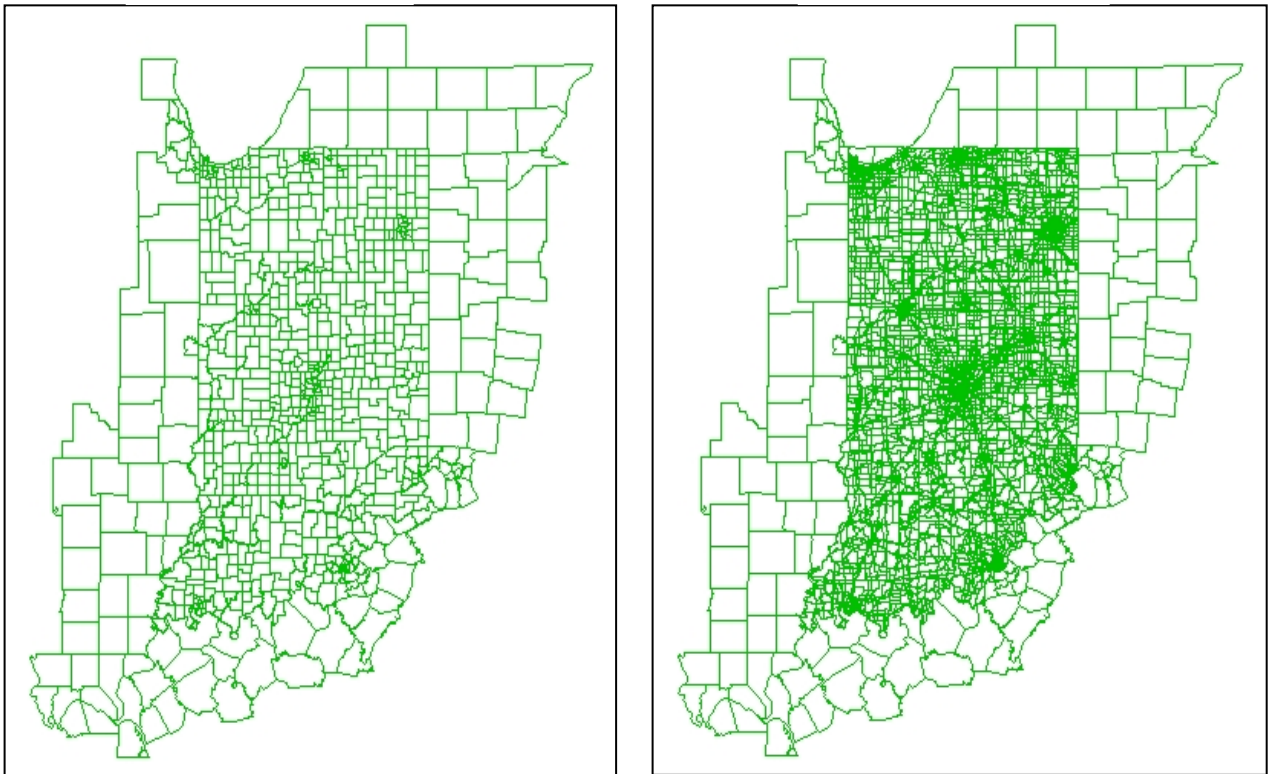
Model Development

INDOT's first TransCAD based GIS ISTDM was developed in the mid 1990's as part of the Major Corridor Investment-Benefit Analysis System (1998) as a systems-level planning tool to provide statewide and corridor estimates of current and future year travel demand. The model has since evolved and has served as the catalyst for various statewide planning studies and associated model developments including the Interstate Interchange Planning Study (2000), and the I-69 Evansville to Indianapolis Tier 1 EIS (2001). For the 2004 ISTDM upgrade, enhancements were incorporated into the I-69 ISTDM model expanding the model's planning year horizon from 2025 to 2030 and adding significant detail to the model's input data files. Summarized below are some of the major refinements incorporated in the ISTDM model update:

- **Traffic Analysis Zone Refinement.** One of the most significant improvements to the ISTDM is the refinement of the Traffic Analysis Zones (TAZ) structure. TAZ are geographic zones in the modeled area containing socio-economic information such as: population density, household size, automobile ownership, household income, and employment data. TAZs provide the model with origin and destination trip estimates occurring from one zone to other zones. For the ISTDM update, the TAZ structure was enhanced by adding a significant number of TAZs within the Indiana area that conformed to a refined roadway network, 2000 census blocks, 2000 Census Transportation Planning Package TAZ boundaries. In addition, stratification curves were incorporated into the TAZs allowing household data to be cross-classified into categories based on average zonal characteristics. The addition of stratification curves into the ISTDM allowed trip rate sensitivity to changes in household size, auto ownership, and average household income over periods of time. The result from these zonal refinements increased the zonal detail from 844 zones to 4,720 zones and improved the model's overall reliability and accuracy. **See Figure 9-2**
- **Model Network Update/Refinement** - Networks are systems of connectivity links used by travel demand models which represents existing or planned roadway alignments. Model networks allow the attachment of pertinent roadway data such as: length, number of lanes, lane width, speed, capacity, and traffic count information. For the ISTDM upgrade, INDOT's new Road Inventory Data (RID) for year 2000 was attached to the network allowing accurate roadway characteristic data to be analyzed, displayed, and used by the model. In addition, the ISTDM upgrade network which is based on the I-69 ISTDM 26-county extensive roadway network detail utilized for the I-69 corridor analysis was expanded to the remainder of the state; increasing the network detail from 18,000 links (23,000 miles of roadway) to 25,000 links (32,000 miles of roadway). **See Figure 9-3**

- **Statewide Traffic Signal Incorporation** - The location of nearly 3,900 traffic signals (approximately 2,600 on state jurisdictional highways) along with priority of signal approaches were coded into statewide network. Information associated with traffic signals were used for estimating more realistic link impedances by considering signal delays. The signals were placed in the network using two data sources: first an INDOT point layer for traffic signals on state jurisdictional system circa 1997 was tagged into the network. Second, signals on local jurisdictional roads were located by means of INDOT's geo-coded crash database for 1997 through 1999 using a flag field which identified the presence of a traffic signal. This methodology covered all roads and all signals where there was a crash of any type between 1997 and 1999. While it is reasonable to assume there are a few signals missing, the crash database is the best available source for signals on local roads at the moment. The traffic signal locations coded on both state and local jurisdictional systems are presented in **Figure 9-4**.

Figure 9-2 ISTD Traffic Analysis Zone Comparison



Existing Plus Committed (E+C) Network Development

Committed projects in the ISTDM network are major long range plan expansion improvements which are significantly advanced in the development process indicating with a high degree of certainty that the project will be constructed. Committed projects in addition to the existing roadway network provide the analysis framework to identify system capacity deficiencies. The ISTDM upgrade existing plus committed network was developed using a 2000 base year network of existing roadway and identified “committed” projects. Committed improvements were identified using the following 3-phase selection criteria resulting in 29-committed projects at a total \$801 million cost estimate:

Criteria 1: The project must be an added travel lanes, new interchange, or new road construction type project.

Criteria 2: The project must have a “Ready for Contracts” (RFC) date of 2008 or earlier.

Criteria 3: Associated environmental studies or Right of Way should be cleared, completed, or near completion.

The ISTDM utilizes the existing plus committed (E+C) network to evaluate the performance of the existing roadway system once selected future year traffic volumes are assigned. E+C network analysis provide vital performance data that is used to identify future transportation needs and for comparing alternative improvement analysis. The Highway Economic Requirement Systems_State_Indiana (HERS_ST_IN) program discussed later in the chapter, also utilize the E+C network to perform additional transportation needs analysis. These needs analysis becomes the bases for future network development and alternative improvement identification.

Figure 9-3 ISTDM Network Comparison

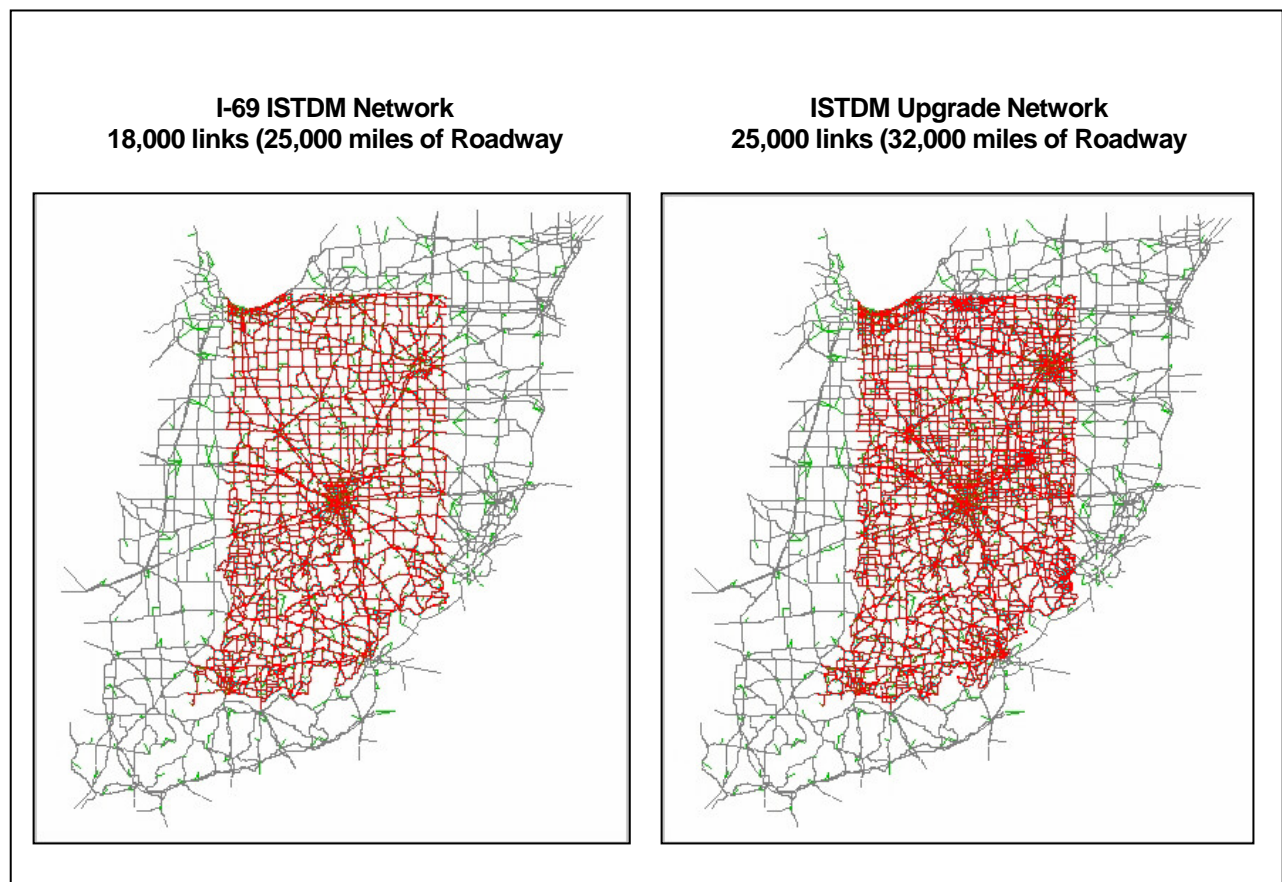
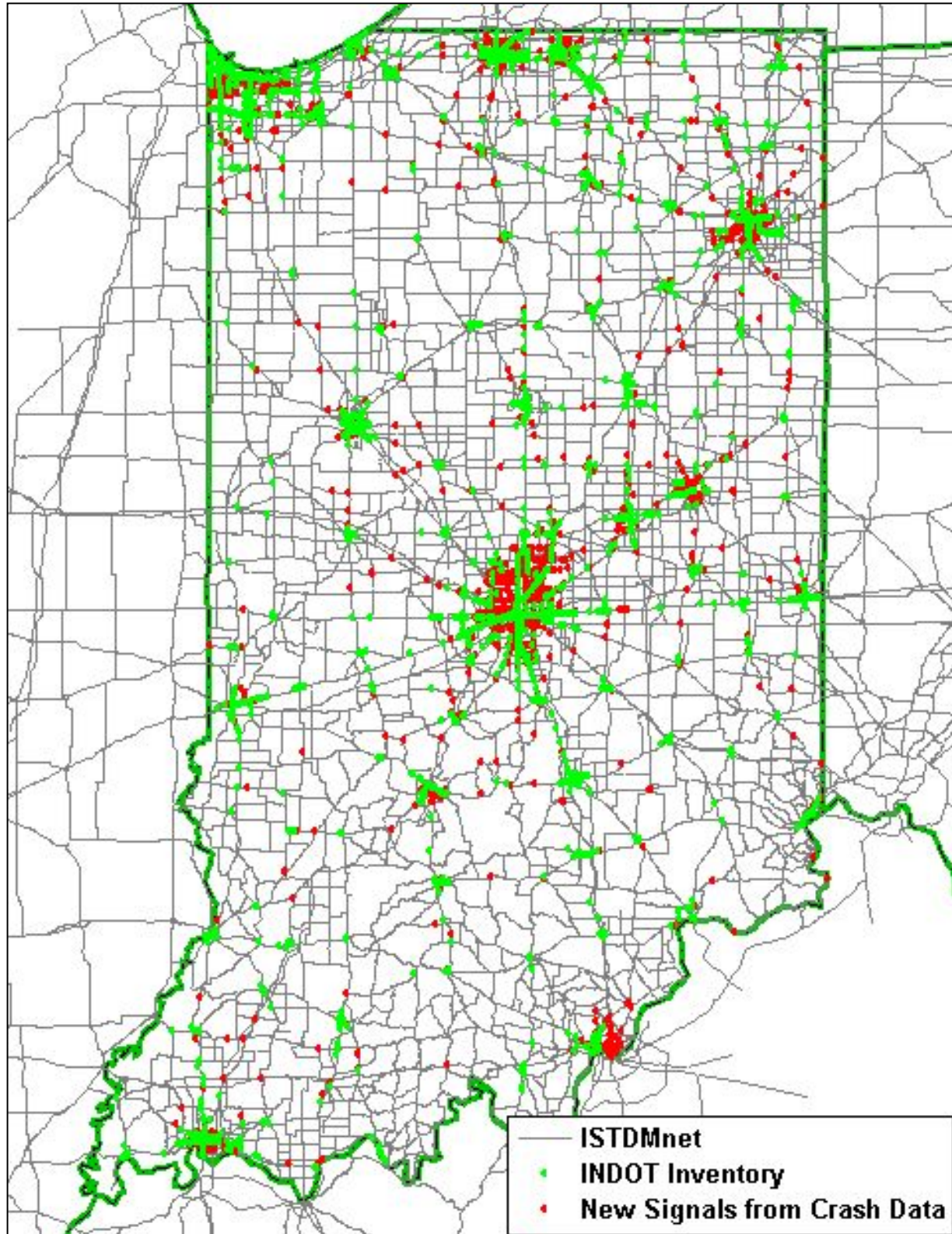


Figure 9-4 ISTDM Statewide Traffic Signal Location Data



Long Range Plan Project Evaluation

One of the primary uses for the ISTDM is to evaluate alternative improvements considered for or listed in INDOT's Long Range Transportation Plan. Project evaluation provides vital input regarding the feasibility and performance of identified improvement alternatives.

To facilitate ISTDM project evaluations, two network outputs are necessary: a 2030 "No-Build" Network and a 2030 "Build" Network. The no-build network, also known as the "do-nothing" network, consists a roadway network as it exists today, plus INDOT projects identified as "committed". The no-build network provides information of how the roadway network will perform if forecasted 2030 traffic volumes are assigned.

The 2030 Build network is similar to the no-build network but incorporates proposed improvement alternatives identified in the INDOT long range transportation plan into the roadway network. Build networks provides systems-level statistics of how the roadway network with implemented improvements performs if forecasted 2030 traffic volumes are assigned. When both networks are compared, decisions are made regarding need for the project.

For the 2030 plan update, maps of each build and no-build network were presented to various planning organizations and INDOT District Office staff for their review, analysis and comments. Figure 9-5, shows sample network analysis maps presented to the various organizations. Note: the model networks are displayed by Levels of Service (LOS) classifications from LOS "A" (free-flowing, no congestion) to LOS "F" (Severe congestion).

Travel Forecast and Systems-Level Performance

Traffic growth rates from the ISTDM are used to identify future year traffic volumes on specific highway links. The ISTDM develops future year traffic volumes based upon forecasted socio-economic growth. Over the 2000 to 2030 time period, statewide population is forecasted to increase 20%, statewide employment is forecasted to increase 18%; however, travel demand is estimated to increase much more rapidly at 52%.

INDOT's standard for acceptable levels of congestion are no worse than LOS C in rural areas and no worse than LOS D in urban areas. In the year 2000, there were 409 miles of state jurisdictional roadway (or 3.6% of the state jurisdictional network) with unacceptable levels of congestion. In 2030, assuming no new roadway improvements, there will be 1,503 miles of roadway (13.4% of the network) with unacceptable levels of congestion. However, construction of the projects currently in the long range plan reduces this number to 1,011 miles (8.8% of the network).

While the miles of roadway with poor levels of service increase, albeit much less, despite the build-out of the long range plan, another measure of system performance, average system speed (total vehicle miles of travel divided by total vehicle hours of travel) improves over the base year, increasing from 48.4 mph in 2000 to 49.9 mph in 2030.

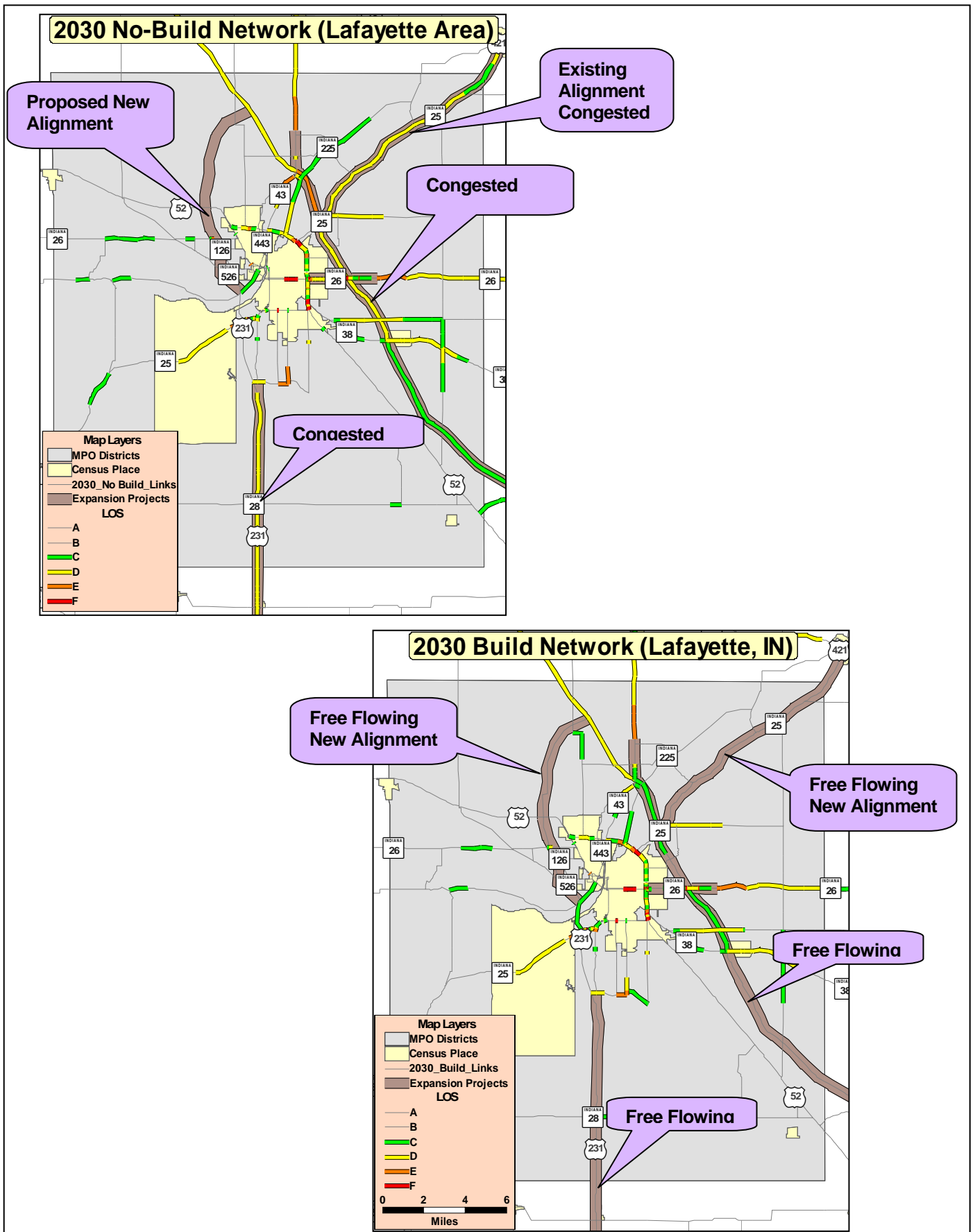
Economic Impacts of the ISTDM

INDOT has a unique role in sustaining and fostering Indiana's economy and recognizes that policy decisions and transportation infrastructure investments have major effects on economic growth and development. To support economic competitiveness, INDOT will improve upon Indiana's high quality transportation system to reduce the cost of moving people, goods, and freight, connect Indiana with regional, national, and international markets, provide communities with an edge in competing for jobs and business locations, and connect people with economic opportunities.

To determine the effectiveness of the Long Range Plan at achieving this economic development goal, the economic impacts of the projects included in the proposed 2003-2027 update of the Long Range Plan were analyzed. The analysis was limited in scope to "added capacity" highway projects. It does not include routine maintenance/preservation projects and investments in other modes of public transportation. Moreover, highway projects that have not been well defined in terms of their location or scope were excluded from the analysis. The analysis treated direct benefits to users of the transportation system (cost savings) as productivity improvements that ripple through the economy. We then compared the total benefits of the Long Range Plan to its costs producing the following:

- Assuming a 7 percent discount rate, the Long Range Plan has a benefit/cost ratio of 4.6 and a net present value of \$13.8 billion in 2000 dollars.
- User benefits are estimated to total \$2.7 billion per year (in 2000 dollars) by the 2028 forecast year. This includes \$1.9 billion in travel time savings, \$236 million in vehicle operating cost savings, \$508 million in accident cost reductions.
- In 2028, the first year after all investments have been made, Indiana residents could be expected to enjoy an additional \$1.1 billion (in 2000 dollars) in real personal income.
- Other economic impacts of the Long Range Plan include 15,000 additional jobs not directly associated with construction of the Plan's projects and over-and-above those jobs expected to be created in the absence of the Plan. The Plan will also produce \$2.2 billion in additional Gross State Product, and \$4 billion in additional business output, all in 2000 dollars for the 2028 forecast year. Additional jobs represent a cumulative impact, while Gross State Product and business output are annual impacts.
- The total discounted benefits of the Long Range Plan over the entire forecast period are estimated to be \$17.6 billion assuming a 7 percent discount rate. Discounted benefits include travel time savings for non-business trips, vehicle operating costs for non-business trips, accident cost savings for non-business trips, and real personal income. The personal income benefit captures the user benefits associated with all business-related trips, plus the indirect and induced effects of the transportation projects on the regional economy.
- The total discounted cost of the Long Range Plan, including capital costs, operating and maintenance costs, and residual value over the lifecycle of investments, is estimated to be \$3.8 billion assuming a 7 percent discount rate.

Figure 9-5 Model Analysis Maps



One of the system planning tools developed for statewide transportation plan development is the Highway Economic Requirements System for Indiana (HERS_ST_IN). HERS_ST_IN is a long-range planning tool for the analysis of highway system investments. HERS_ST_IN is developed from the National Highway Economic Requirements System developed by the Federal Highway Administration (FHWA) for national highway investment analysis. The FHWA model is used in conjunction with the national Highway Performance Monitoring System data collection program to prepare a biennial report on the state of the nation's highways entitled the *Conditions and Performance Report to Congress*. INDOT has modified the national model for specific application to Indiana's highway system analysis needs in developing HERS_ST_IN. The major modifications for HERS_ST_IN are focusing the analysis on added travel lanes projects which add capacity to the highway system, the use of INDOT's computer database, the road inventory system to provide a 100% sample of our state jurisdictional highway system, and the use of a geographic information system (GIS) approach to all statewide mapping and display.

HERS_ST_IN identifies needed added travel lane improvements by calculating highway capacity deficiencies over the year 2000 to 2030 planning period. HERS_ST_IN evaluated these forecasted highway deficiencies using a cost/benefit economic analysis approach to identify the need for an added travel lanes project and the most appropriate time period to make the improvement. HERS_ST_IN identifies a potential added travel lanes project, calculates the estimated cost of the improvement, compares that to the project benefits (travel time savings, reduced accidents, and vehicle operating expense), and assigns the improvement to one of five improvement phases on the basis of a cost/benefit ratio.

HERS_ST_IN provides a statewide highway analysis tool, which allows the testing of a wide range of "what if" scenarios. The analysis can evaluate the system performance impacts of using different levels of benefit/cost ratios to select highway investments, the use of different capacity levels to identify deficiencies, and the use of alternative levels of investments. The HERS_ST_IN analysis, at this time, is limited to the evaluation of the existing highway system. The analysis of new highway links, such as new inter-city highways providing new connections need to be evaluated through other system planning tools such as the statewide travel demand model. In the near future, several new features of the HERS_ST_IN needs analysis model are anticipated to be used in the continuing statewide planning process. These include the ability to code in the entire range of proposed highway added travel and new highway connections for the development of overall system performance and calculation of benefit/cost measures for each proposed highway improvement project. See Figures 9-6 & 9-7

Project Identification and Rationalization

The HERS_ST_IN improvement needs were used as one element in the overall process of determining statewide proposed highway improvements. The HERS_ST_IN improvements were selected without data on the actual feasibility of highway widening (a future feature for the continuing planning process). In addition, HERS_ST_IN improvements are identified and a rationalization process is required without the overriding parameter of system continuity to establish logical project limits. In order to use the HERS_ST_IN information for project identification, a review process was conducted with District, MPO and Central Office personnel. As part of this process, INDOT District and MPO area maps were prepared showing HERS_ST_IN identified added travel lanes projects. Key local transportation personnel reviewed the initial HERS_ST_IN output and made necessary adjustments.

Figure 9-6 HERS_ST_IN Identified Deficiencies

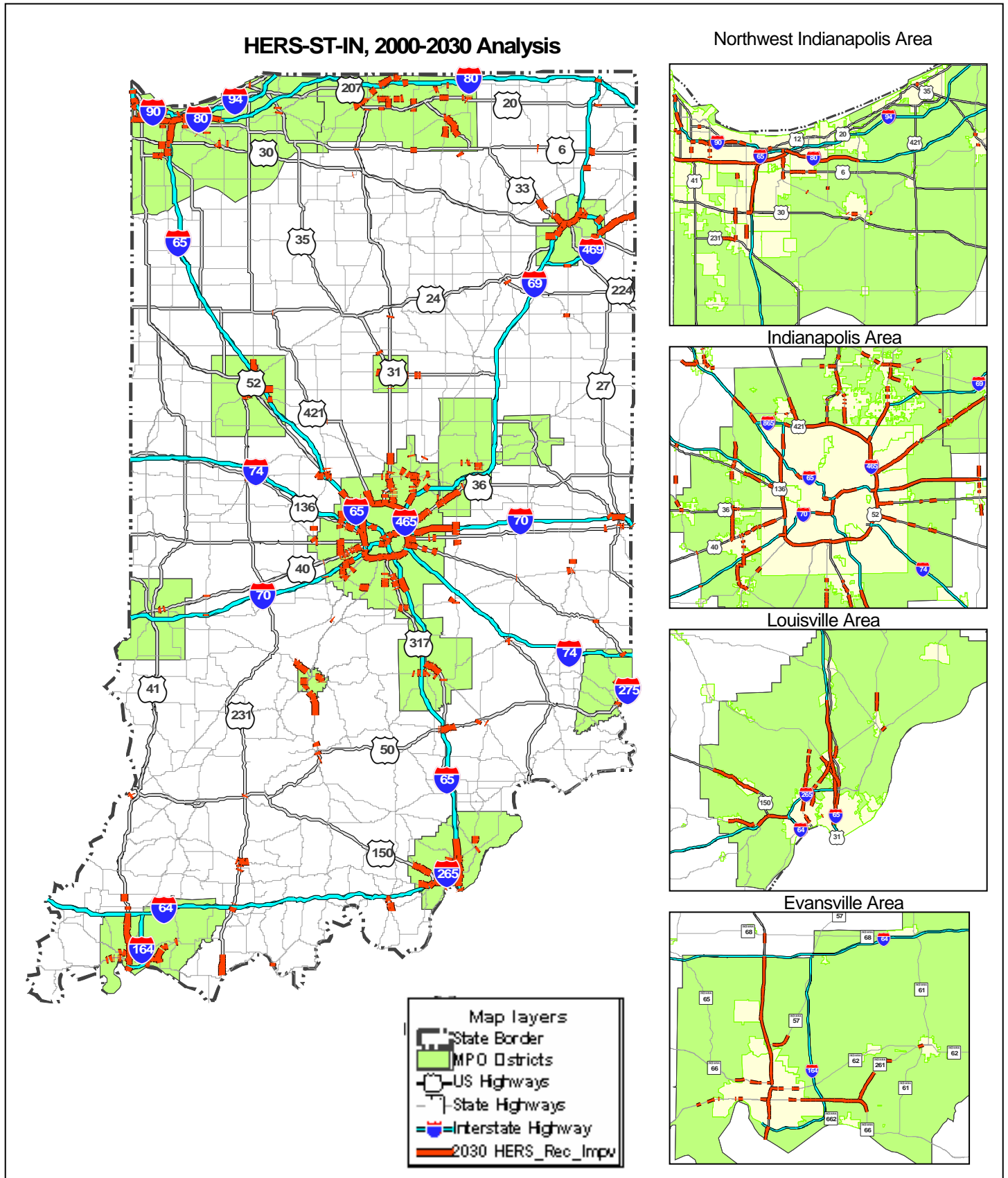
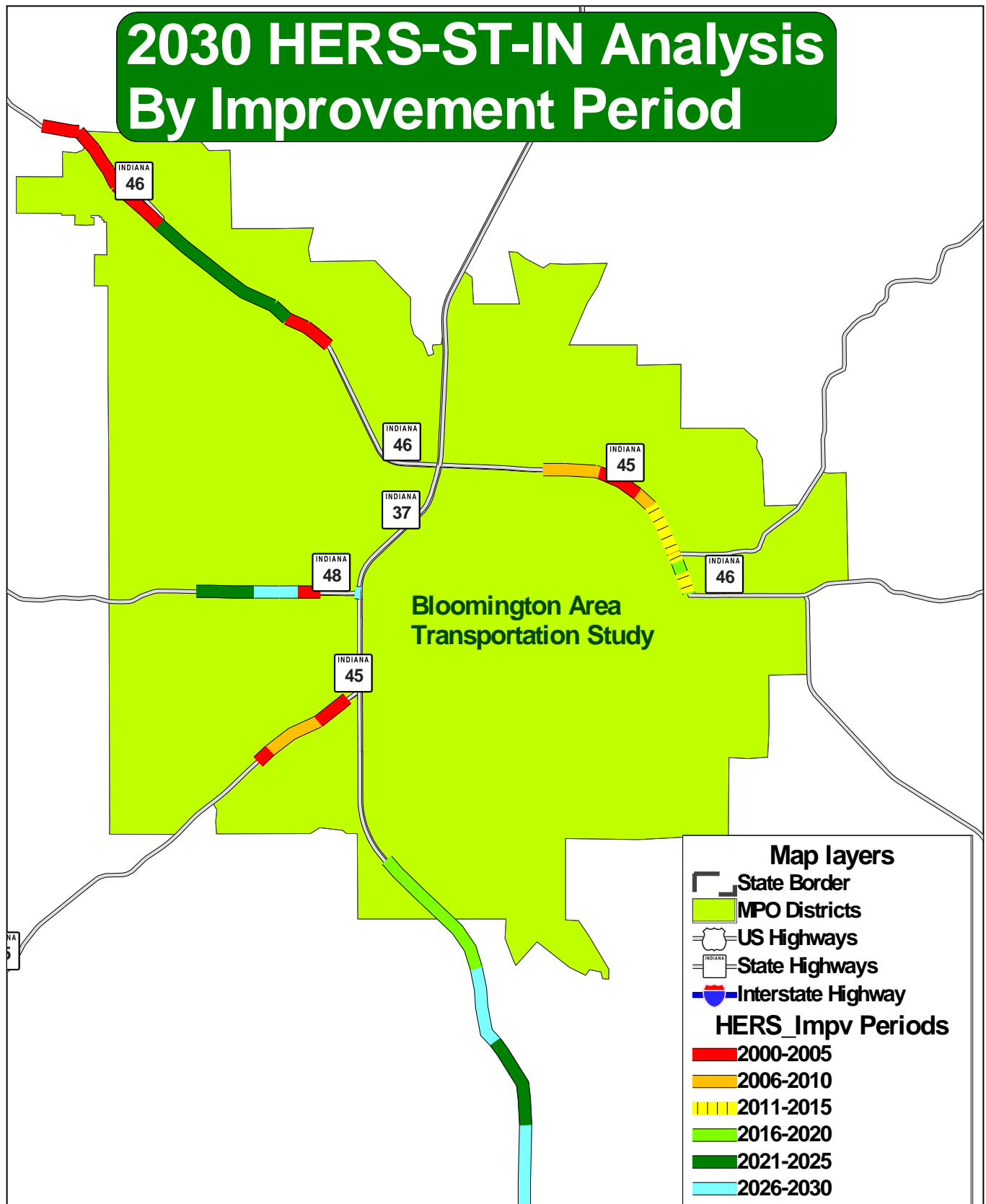


Figure 9-7 HERS_ST_IN Recommended Improvements



Indiana Interstate Interchange Study

A major element in the development of an efficient statewide system of transportation is the provision for Interstate interchanges which operate at an acceptable level of service for traffic operations, operate safely, and are up to date relative to today's geometric standards. To address these issues, INDOT has prepared the Indiana Interstate Interchange Planning Study. This study updated the previous Interstate Interchange Evaluation Study undertaken by INDOT in the late 1980s. The interchange study has developed improvement recommendations and priorities for the nearly 250 existing interchanges on the Interstate System, plus evaluated the feasibility and need for 11 new interchange locations. A summary of the finding of the analysis of new interchanges is shown in table 9-1. The recommendations of this interchange study provide the foundation for the interchange improvement program in terms of interchange modifications and new interchange development. All Interstate interchanges are evaluated with the exception of the Indiana Toll Road interchanges, which are analyzed in a separate INDOT process. The interchange study evaluates the potential interchange improvement needs by studying the following factors: (1) accident frequency and severity, (2) future traffic volumes and interchange level of service (congestion), (3) geometric deficiencies and, (4) pavement and bridge conditions. Each interchange is placed into an analysis category. Interchanges which are under active INDOT improvement study or which have current improvement projects underway are included only in the inventory phase of the study. Interchanges in rural areas with no significant new development occurring in the area receive only limited study. The majority of study resources are directed toward interchanges located in areas with rapidly increasing development pressure and higher traffic volumes.

The final report recommendations include a list of improvements and associated estimated costs per interchange. As noted above, the report's recommendations will drive our interchange modification and new interchange construction program for the next 5 to 7 years and beyond. An estimate of identified interchange improvement needs has been included in the project listings in Chapter 11. Work continuing the analysis will proceed provided the interchange system for both the interstate and non-interstate routes are included in the statewide planning work program for 2005 and 2006.

A listing of recommended interchange improvements has been provided in **Appendix A**.

Figure 9-8 Interchange Locations

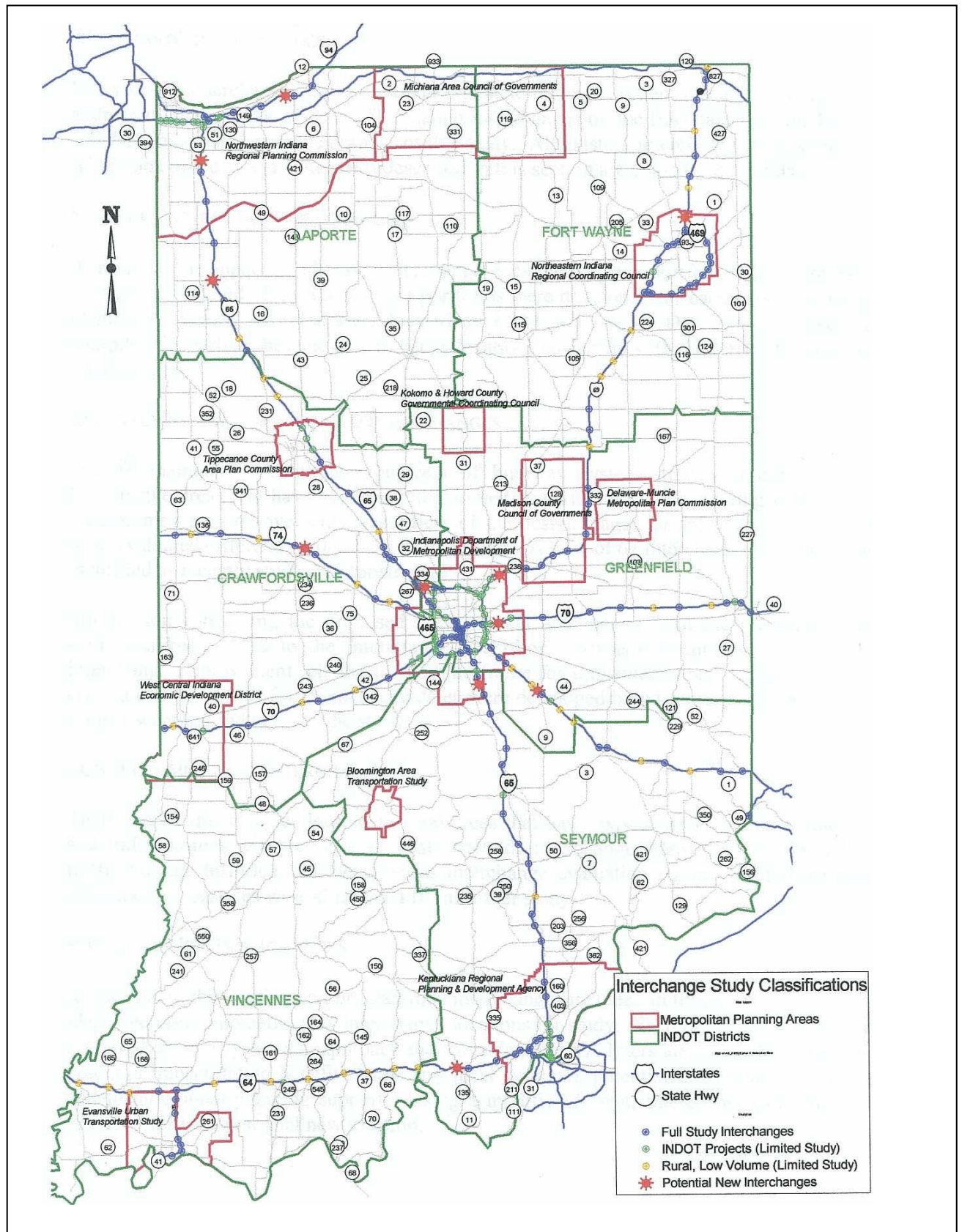


Table 9-1

Potential New Interchange Summary Index

Location		Justification/Benefit			Apparent Feasibility				
Interchange	County	Interstate System	Local System	Economic Devt	FHWA Rqmts	Env (NEPA)	Plan MPO	Support Local	Economic Devt
I-64 Gethsemane Rd	Harrison	X	X	included	Yes Other: Additional study needed to confirm benefits and preferred location	Yes	--	No	New
I-65 CR750N	Johnson	X	X	included	Yes* Other: Part of Greenwood Plan Update (under way) /MPO review pending	Yes	TBD	No	New
I-65 SR 14	Jasper		X	X	Yes Other: Serves emerging dairy industry; strong multi-county support	Yes	--	Yes	Exist/New
I-65 101st Avenue	Lake	X	X	included	Yes* Other: Lake County Plan Commission prefers 109th Avenue location	Yes	Yes	No	New
I-69 126th Street	Hamilton		X	included	Yes* Other: Suggested by Fishers/MPO review pending	Yes	No	No	New
I-69 Gump/Hursh Rd	Allen	X	X	NO	Yes Other: MPO plan shows 2010 construction	Yes	Yes	Yes	Restricted
I-70 German Church Rd	Marion	X	X		Yes Other: MPO plan shows 2007 - 2015 construction	Yes	Yes	Yes	--
I-74 SR 47	Montgomery		X	X	Yes Other: intended to improve access for local businesses	Yes	--	No	Exist/New
I-74 Michigan Rd	Shelby	--	--	--	Yes Other: Local plans being changed. Improve Fairland interchange instead	TBD	--	No	--
I-94 County Line Rd	LaPorte/Porter		X	X	Yes Other: Listed by MPO, but not in cost feasible plan; serves existing commercial	Yes	No	Yes	Exist
I-465 Cooper Rd	Boone	X	X	No	Yes Other: Adopted in Boone County and Zionsville Plans MPO review pending	TBD	No	Yes	Restricted

*INDOT rural interchange spacing criteria of 5KM (3.11 mi) not met at this location

Priorities - Interstate System

I-69 & Gump/Hursh Rd
I-70 & German Church Rd
I-465 & Cooper Rd (tentative)
I-65 & 101st Ave (tentative)
I-64 & Gethsemane Rd (tentative)

Priorities - Local System

I-69 & Gump/Hursh Rd
I-6465 & Cooper Rd
I-65 & CR750N (tentative)
I-65 & 101st Ave (tentative)
I-64 & Gethsemane Rd (tentative)

Priorities - Economic Development

I-65 & SR 14
I-94 & County Line Rd
I-74 & SR 47 (tentative)

Additional study needed for consensus/justification

I-465 & Cooper Rd -- MPO plan support needed
I-94 & County Line Rd -- MPO plan support needed
I-65 & 101st Ave -- MPO/loc consensus needed
I-74 & SR 47 -- Local plan support needed
I-64 & Gethsemane Rd -- Local plan support needed
I-65 & CR 750N -- MPO & Local plan support needed
I-69 & 126th St -- MPO & Local plan support needed

Summary

The statewide transportation planning process provides for the identification of highway needs through a comprehensive process, which involves encompassing previously identified projects, conducting statewide technical needs analysis, and utilizing the HERS_ST_IN Model. By assembling these elements, an unconstrained listing of the state's transportation needs is created. Upon creation of this listing, the next task is to filter through the projects to identify logical needs, and to prioritize the projects based on those needs.